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**ELECTRONICS AND ELECTRICAL ENGINEERING**

**No. 67**

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12 June 1980

# USSR REPORT

## ELECTRONICS AND ELECTRICAL ENGINEERING

No. 67

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CERTAIN ASPECTS OF COMPUTER HARD AND SOFT WARE; CONTROL,  
AUTOMATION, TELEMCHANICS; MACHINE DESIGNING AND PLANNING

UDC 681.3.01

METHODS AND MEANS OF PREPARATION OF INFORMATION FOR COMPUTERS

Moscow IZMERENIYA, KONTROL', AVTOMATIZATZIYA: NAUCHNO-TEKHNICHESKIY REFERATIVNYY SBORNIK in Russian No 1-2, 1980 signed to press 6 Dec 79 pp 37-40

SAVETA, N. N., candidate of technical sciences

[Abstract] Existing data entry methods are surveyed. All data entry methods are divided into two groups: those in which verification is performed before the data are recorded on the machine-readable carrier; and methods such as double punching and verification in which the information is edited and errors are detected after it has been recorded in machine-readable form. Traditional card punching, key-to-tape and multi-terminal minicomputer-buffered methods of input are described. Figures 4; tables 1; references: 2 Russian. [195-6508]

UDC 681.327.6

MAGNETIC MEMORY DEVICES AND PROSPECTS FOR THEIR DEVELOPMENT

Moscow IZMERENIYA, KONTROL', AVTOMATIZATZIYA: NAUCHNO-TEKHNICHESKIY REFERATIVNYY SBORNIK in Russian No 1-2, 1980 signed to press 6 Dec 79 pp 32-36

KOLOS KOV, M. S., candidate of technical sciences

[Abstract] Although the density of information storage in ferrite core memories has probably approached its limit, the high speed and level of development of ferrite cores indicates that this type of memory will continue to be important in computers for some time. The broad introduction of 64 K semiconductor memories has largely displaced core as main memory, leaving it to be used as very rapid access relatively large nonvolatile storage. This article, based primarily on American data, analyzes the relative position of traditional magnetic memory devices such as core, disk, drum and tape versus such new technology as magnetic bubble memory, charge-coupled devices and CRT memory on the scales of capacity, access time and cost. Figures 1; references 17: 8 Russian, 9 Western. [195-6508]



## CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION

### MEASUREMENT AND CHECKING OF RADIO AND TELEVISION TRANSMITTING STATIONS

Moscow VESTNIK SVYAZI in Russian No 2, Feb 80 pp 20-22

DVORKOVICH, V. P., senior scientific research worker, Scientific-Research Institute of Radio Broadcasting (NIIR)

[Abstract] When radio and television transmitters operate under remote control, specific requirements must be placed on the measurement and checking systems used. A number of devices for measurement and checking of radio and television transmitters and television networks have been developed in recent years. This article describes a number of such devices, including the G6-30 television measuring signal generator, and the K2-36 oscilloscopic measuring device designed to operate with the G6-30. Drawings of wave forms are presented which assist in diagnosis. Figures 3.  
[194-6508]

### RELIABILITY OF REMOTE CONTROL OF TELEVISION RELAYS OF LOW POWER

Moscow VESTNIK SVYAZI in Russian No 3, Mar 80 pp 21-23

OBUKHOVICH, V. T., chief engineer, MARULIN, V. I. and KLYZHENKO, T. I., senior engineers, NIIR (probably Scientific-Research Institute of Relay Construction)

[Abstract] In order to improve the reliability of radio relaying in television systems by remote control with conventional low-power TRSA and RTsTA relays, it has been found necessary to redesign the automatic control modules and the output stage of picture transmitters so as to ensure a more stable radio signal. The automation modules are now built with closed-construction RES-8 and RES-32 relays, instead of the old open-construction RKN relays, and include a standby set for operation according to the principle of independent 2-channel control. Repair and preventative maintenance of transmitter equipment is thus possible without interruption of broadcasting service.



Overcurrent protection is provided in the plate circuit of GU-33B and GU-34B tubes so as to prevent failure of these tubes as well as burnout of instruments due to overheating, especially in the absence of a modulating signal, a major cause (20 percent) of shutdowns. This is achieved by means of a relay and switching system which includes an overcurrent relay with a counter and a secondary relay. The former operates three times within 3 seconds, before the latter finally disconnects the plate and the grid. Automatic reclosing occurs 5 minutes after the loss of signal. An auxiliary relay on the receiver side automatically grounds the grid. The performance of the radio relay system is stabilized by automatic regulation within  $\pm 2$  percent of the video signal and by stabilization of the supply voltage against fluctuations of the 220 V line voltage ranging from -15 to +10 percent, with the secondary of an auxiliary transformer connected in series into the output circuit of an RNO-250-5 regulator. All these modifications have been proved to improve the reliability of radio relaying and to ensure the possibility of operation either automatically or by remote control. Figures 4.

[221-2415]

COMMUNICATIONS; COMMUNICATION EQUIPMENT INCLUDING RECEIVERS  
AND TRANSMITTERS; NETWORKS; RADIO PHYSICS;  
DATA TRANSMISSION AND PROCESSING; INFORMATION THEORY

UDC 621.391

SELECTION OF PARAMETERS FOR THE ALGORITHM OF DISCRETE EXPONENTIAL SMOOTHING

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 23 No 3, Mar 80 pp  
7-9 manuscript received 6 Jun 79

PRYANISHNIKOV, V. A.

[Abstract] The k-step algorithm of discrete exponential smoothing  $m_k = m_{k-1} + \alpha(x_k - m_{k-1})$  is considered which yields an estimate of the mean value of a sequence of uncorrelated samples from a population with both the mathematical expectation  $m_x$  and the dispersion  $\sigma_x$  unknown. Here  $m_k$  and  $x_k$  are the estimate of the mean value and the sample value on the k-th step ( $k = 1, 2, \dots, n$ ) and  $\alpha$  ( $0 < \alpha = \text{const} < 1$ ) is the smoothing factor. This algorithm is analyzed statistically, the ratio of dispersion  $\sigma^2(m_n)$  to mathematical expectation  $M(x)$  is calculated as a function of the variation coefficient  $\sigma_x/m_x$  for various values of the smoothing factor  $\alpha$ , so that the parameters of this algorithm can be optimized on this basis. The paper was recommended by the Department (Kafedra) of Electrical Engineering, Leningrad Institute of Precision Mechanics and Optics. Figures 1; references: 2 Russian.  
[218-2415]

## 'KURS' EQUIPMENT AND ITS USES

Moscow AVTOMATIKA TELEMEKHANIKA I SVYAZ' in Russian No 3, Mar 80 pp 23-25

CHABANENKO, N. M., engineer

[Abstract] "Kurs" equipment has been built for faster and more reliable data transfer and processing, without transducer segments and perforated carriers, with a smaller operating staff and lower operating costs. It links electrically an "Akkord-1200" data transfer set and a "Luch" device with a "Minsk-1560" computer, either directly or through preliminary data processing equipment. It thus becomes possible to duplicate transmitted or received data on a PL-150 punch and/or on an ATsPU-128 alphanumeric printer, through a coupler with a printing automatic system of programmed control, then to feed the data to either "Minsk-1560" or FS-1501 equipment. Further, "Kurs" equipment makes it possible to tie together an unlimited number of "Minsk-32" computers, capable of simultaneously serving in real time up to 96 subscribers over independent telephone and telegraph communication lines. "Kurs" equipment has been designed for unilateral, simultaneous, or alternate data transmission and reception. It can also operate in the computer-dialog and in the computer-user dialog modes. Energized from a 1-phase 220<sup>+</sup><sub>-13</sub> V - 50±2 Hz source, it draws 200 VA. It is built with transistor-diode<sup>13</sup> logic, the overall package without the data transfer device, measures 260x654x645 mm<sup>3</sup>. Figures 2.

[229-2415]

## OPERATION OF THE 'IGLA' TELEVISION-RADIO STATION IS BEING MADE MORE RELIABLE

Moscow VESTNIK SVYAZI in Russian No 3, Mar 80 pp 29-31

FRIDMAN, E. M., head of Central Laboratory, All-Union Radio-Television Transmitting Station imeni 50 years of October, KUDRYAVTSEV, V. S., chief specialist, Production Laboratory; and YUSHKIN, A. I., chief specialist, Central Laboratory

[Abstract] This latest progress report on improvements currently made in the "Igla" TV radio station in order to provide better and more reliable service, covers redesign of the output stage and the third (last) frequency multiplier stage as well as of the reference quartz oscillator and the low-power system. Contact resistances in the plate circuit of the output stage with a tuning plunger have been minimized, taking into account the wear

characteristics of silver and phosphor bronze. A maximum power of 5.0 kW can be delivered by the last output stage, after the 2.0-kW GU-40B oscillator tetrode has been replaced with the more efficient GU-35B. In the last of three frequency triplers (3/9/27) periodic contact burning and arcing have been eliminated by replacement of the GU-33B oscillator tetrode with the GU-70B, requiring a new grid device, and this will be later replaced with the GS-36B. Dephasing and detuning here are eliminated by increasing the allowable phase shift from 6.7 to 20°, with a 180° locking range of the automatic phase frequency control, which has been achieved by transferring one frequency tripler stage from the low-power system to the reference oscillator stage. The low-power system is, furthermore, stabilized by means of amplitude limitation with a plate-grid circuit using a pentode. A plate power dissipation (21 W) in the second low-power stage far below the maximum allowable (40 W) and a constant high-frequency voltage at the output stabilize the cutoff angle of the plate current and thus the differential characteristics of the picture channel. Further improvements are planned for implementation in 1980. Figures 6.  
[221-2415]

#### AN AUTOMATED SYSTEM FOR SWITCHING OF RADIO PROGRAMS

Moscow VESTNIK SVYAZI in Russian No 2, Feb 80 pp 24-26

MALYAKIN, V. P., chief engineer, SUR-2; BRITOV, G. S., docent of Department (Kafedra) of Automated Control Systems (ASU), Leningrad Institute of Aviation Instrument Building; LUPAL, V. V., chief of educational laboratories, and KOROLEV, G. V., computer chief

[Abstract] Computerized automation of switching and distribution of radio programs includes the processes of switching of broadcast programs, radio broadcast quality assurance, accounting for the time transmitters are on the air, accounting for technical failures, control of remote switching of transmitters and many other processes frequently performed manually at present. Series-produced general-purpose computers are suitable for this type of automatic control, given the requisite input-output devices, software and real-time operating capability. A complex structural diagram is presented, showing the flow of operations in a radio program switching system using such a computer. The automated system for switching of radio programs has been experimentally tested. Further development of the system will include expansion of the range of tasks performed and modernization of the software to simplify operation of the system. Figures 3.  
[194-6508]

## THE VLT-24R HIGH-FREQUENCY TRANSMISSION SYSTEM

Moscow VESTNIK SVYAZI in Russian No 2, Feb 80 inside of front and back covers

GEBOVIUS, O. G., chief engineer, Central Scientific Research Institute of Communications (TSNIIS), GERASIMOV, A. M., senior engineer and PARKHOMENKO, V. N., section chief

[Abstract] The VLT-1920 transistorized apparatus, developed in East Germany on assignment from the Ministry of Communications, USSR, is now being used in the USSR to organize new coaxial cable main communication lines and to replace the K-1920 and K-1920 U tube-type devices previously in use. The VLT-24R device is also being introduced on balanced pairs of coaxial cables in order to organize communication between reamplification points on main communication lines equipped with the VLT-1920 device. The VLT-24R forms 24 standard telephone channels on a pair of balanced coaxial cables. It operates in the 12-108 KHz range and uses two test frequencies of 16 and 104 KHz for automatic compensation of temperature changes in cable attenuation. A photograph and three diagrams showing the formation of the line frequency spectrum, and a block diagram of a line section and its equipment are presented. Figures 3.

[194-6508]

## WAYS TO REDUCE THE COST OF INSTALLING CABLE TRUNKS

Moscow VESTNIK SVYAZI in Russian No 3, Mar 80 pp 37-38

PARKER, YU. D., head, Laboratory for Station-Tuneup Operations, "Mezhdorsvyaz'-stroy" All-Union State Trust for Construction of Long-Distance Wire Communication Equipment

[Abstract] Reducing the construction cost of long-distance cable trunks has become an urgent problem, in view of the continuing expansion and modernization of communication networks through use of more reliable and economical equipment as well as more efficient service. A budget analysis indicates that most expenditures are for equipment in attended repeater stations, for enclosures and buildings, for electric power supplies, and for technological apparatus. Here possible cost reductions are considered in the typical case of a 184 km long VLT-1920 system with KM-4 cables. Tradeoff between attended and unattended repeater stations is an important item in the cost evaluation, in which adequate voltage supply and proper hookup of battery banks must be

taken into account. Other measures toward cost reduction affect assembly, installation, maintenance, testing and repair procedures which will also ensure satisfactory performance characteristics. This applies especially to suppression of intrinsic noise and crosstalk in communication channels, and the effect on it as well as the cost of regulators. This also applies to channel loading and to fault detection. All cost reducing items should be reflected in the applicable documentation pertaining to cable characteristics, deviation allowances, test limits and other specifications. These specifications and technical as well as organizational procedures proposed to ensure that they are met should be acceptable to the interested departments of both the USSR and RSFSR Ministries of Communication. Figures 2; references: 1 Russian.  
[221-2415]

#### A DEVICE FOR FINDING TELEPHONE CABLE WELLS

Moscow VESTNIK SVYAZI in Russian No 2, Feb 80 pp 28-29

NIKITIN, A. A., engineer, Construction Laboratory, Moscow State Trust for the Construction of Telephone Structures ("Mostelefonstroy")

[Abstract] Before new cables can be placed in underground telephone cable conduits, the access wells must be located. This is frequently difficult because the well covers may be covered with dirt or snow and the instructions and diagrams showing their location may be obsolete or vague. The author has developed a metal detector capable of finding telephone well hatch covers buried under snow, asphalt or dirt to a depth of up to 1 m. The detector is distinguished from ordinary metal detectors in that it is specifically attuned to locate metal objects approximately the size and shape of the hatch cover of a telephone cable well. A schematic diagram of the circuit and a photograph of the loop are presented. Figures 2.  
[194-6508]

NEW INSTRUCTION FOR SERVICING AUTOMATIC CONTINUOUS-DUTY LOCOMOTIVE  
SIGNALIZATION DEVICES

Moscow AVTOMATIKA TELEMEXHANIKA I SVYAZ' in Russian No 3, Mar 80 p 46

ROMANOV, V. M., senior engineer. Reliability Department, Central Selection  
Station (TsSS) of the USSR Ministry of Railroads

[Abstract] A new instruction has been written for servicing automatic continuous-duty locomotive signalization (ALSN) devices which complies with the latest rules for USSR railroad operation and incorporates recommendations made by the All-Union Scientific Research Institute of Railroad Transportation. Some of the equipment parameters have been changed and performance requirements made more stringent. Accordingly, the conductor insulation must now be at least 5 M Ohm after a locomotive overhaul, the clearance between pickup coils and the rail head must be 200-280 mm wider, the off time of the pulse relay during a drop of code current from 25 A to minimum level has been reduced from 2 to 1.5 s, but the sensitivity threshold of amplifiers with an autonomous traction system has been raised from 0.6 to 0.75 A. Intervals between preventative maintenance checks have been extended to 6 months for decoders and amplifiers, to 2 years for filters and to 3 years for capacitor banks. Acceptance and routine tests of other signalization equipment on board of locomotives must follow new procedures precisely outlined, but road equipment is excluded from this instruction and will be covered in a separate one. Included here, however, are technical and hygienic requirements relative to test booths and repair shops. The new instruction has been approved by the USSR Ministry of Railroads and will be published in 1980.

[229-2415]



COMPONENTS AND CIRCUIT ELEMENTS, INCLUDING  
WAVEGUIDE, CAVITY RESONATORS AND FILTERS

UDC 621.372.061

DETERMINING THE FORM OF THE OUTPUT SIGNAL AND THE RESPONSE OF THE CIRCUIT  
IN DEVICES WITH PULSE-WIDTH-MODULATION

Minsk IZV. VUZ: ENERGETIKA in Russian No 3, Mar 80 pp 96-100 manuscript  
received 21 Nov 79

ZHUYKOV, V. YA., candidate of technical sciences, and ROGAL', V. V., engineer

[Abstract] Pulse-width conversion of dc voltage is widely used in industry and transport. Determining the form of the output signal and the response of the load circuit reduces to calculating the transform of  $m$ -phase pulse sequences and, in the case of pulse-width modulation of the second kind (trailing edge of pulses), to solving transcendental equations. Here a method is proposed which involves the use of a double Walsh-Fourier series. It is demonstrated with a periodic modulating signal, the ratio of signal frequency to pulse repetition rate being a rational number. The problem is solved in two steps. First the surface of an elementary volume  $S(x,y)$  (a periodic function) is expanded into a double Walsh series and the coefficients of the latter found, the relation between coordinates  $x$  and  $y$  depending on the kind of modulation. With these coefficients one then reconstructs the modulated pulse sequence. This applies to modulation of the first kind or second kind, with various modulating functions such as, for instance, a triangular one. The method is illustrated on the example of determining the load current in the  $k$ -th phase of a polyphase pulse-width converter. Its algorithm is easily programmable on a digital computer. The paper was presented by the Department (Kafedra) of Industrial Electronics of the "Order of Lenin" Kiev Polytechnic Institute imeni 50th Anniversary of the Great Socialist October Revolution. Figures 2; references: 7 Russian. [219-2415]

## DIGITAL BAND FILTERS BASED ON NONUNIFORM DISCRETIZATION

Leningrad IZV. VUZ: PRIDOROSTROYENIYE in Russian Vol 23 No 3, Mar 80 pp 3-7  
manuscript received 7 Jun 79

BELOV, V. K., GRISHKIN, S. N. and PETUKHOV, V. I.

[Abstract] A digital band filter is considered as a series combination of an initial digital low-pass filter and a harmonic filter. Its weighting function is treated, accordingly, as a convolution of the weighting functions of both components. The harmonic filter is, moreover, treated as a comb filter of the first kind in series with  $\epsilon$  comb filters of the second kind,  $\epsilon$  denoting the number of simple numbers among the harmonics to be eliminated in the process of nonuniform discretization. On this basis, the digital band filter is designed to match a given frequency characteristic. A comparison of performance with the  $\epsilon$  comb filters of the second kind in series and in parallel respectively indicates that a higher response speed is attainable in the latter case, but with heavier equipment. The paper was recommended by the Department (Kafedra) of Information-Measuring Technique, Ryazan Institute of Radio Engineering. Figures 3; references: 2 Russian; 1 Western in translation.

(218-2415)

## CONVERTERS, INVERTERS, TRANSDUCERS

UDC 538.632.087.92.089.6

STUDY OF THE CHARACTERISTICS OF FILM HALL CONVERTERS BASED ON n-InSb-1-GaAs

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 48

BESSONOV, V. I., ZVENIGORODSKAYA, A. I., KAZANTSEV, YU. I., LEVITSKAYA, N. V., NOVIKOV, A. P., POSTNYKH, O. A. and TIKHONOV, V. I.

[Abstract] The use of semiconducting thin films can reduce some of the shortcomings of indium antimonide Hall effect converters based on single crystals which have been precision ground to the required thickness. The authors studied specimens of semiconducting heterostructural n-InSb-1-GaAs with a concentration of charge carriers of  $6-9 \cdot 10^{17} \text{ cm}^{-3}$ . The specimens were 5-15  $\mu\text{m}$  thick and were designed for use as magnetic measurement transducers for operation under both normal and cryogenic conditions. The shape and dimensions of the experimental devices are illustrated. The studies indicated that the devices could be used as sensors over a broad range of magnetic field strengths and temperatures: magnetic sensitivity 150-300 mV/T; nominal control current 100 mA; input and output impedance 3-7 Ohms; nonequipotentiality voltage less than 0.2 mV; mean temperature coefficient of magnetic sensitivity between 4.2 and 300 K not over 0.005 percent/K; non-linearity of output voltage between 0.3 and 6 Tesla not over 2 percent, between 1-6 Tesla not over  $\pm 1$  percent; instability of calibration characteristics not over 0.2 percent per 6 months; dimensions 4 X 3 X 0.5 mm. Figures 1; references 7: 4 Russian, 3 Western.

[181-6508]

## INCREASING THE SENSITIVITY OF ELECTROMAGNETIC ANGULAR MOTION SENSORS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 11-13

ARTAMONOV, A. T., VOLKOV, N. P. and MARTIROSYAN, S. T.

[Abstract] Simple technical means are studied for increasing the sensitivity to the input signal of angular motion sensors with electric reduction which do not require a significant increase in the dimensions of the devices, such as an increase of the number of poles of the windings. If the primary and secondary windings are shifted relative to each other by  $1/4$  of the winding step, the coefficient of electric reduction is doubled without increasing the number of poles or the dimensions of the converter. A diagram of another type of converter is presented in which the primary converter is a transformer angular displacement converter with primary windings shifted relative to the secondary windings by  $\pi/4$ . The converter also includes a high frequency voltage generator, an additional low frequency voltage generator, an amplitude modulator, two amplifiers, two amplitude detectors, selective amplifiers and differential amplifiers and output phase-shifting device. The inputs of the modulator receive voltages from the high and low frequency generators, while the output of the modulator receives an amplitude-modulated signal which is fed to the primary windings of the primary converter. Its output voltage is then fed along with its input voltage through the amplifier to the amplitude detectors and the selective amplifiers, detecting the amplitude-modulated voltage so that the output voltage of the entire converter is a low-frequency voltage, the phase of which is proportional to the angular displacement. Figures 3; references: 3 Russian. [181-6308]

UDC 621.3.087.92:531.767

## A WIDEBAND SPEEDOMETER FOR PHOTOELECTRIC CONVERTERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 30-31

KOL'TSOV, I. M., KRYLOSOV, V. V., MIKHEYEV, V. P., ROZOV, B. S. and SHCHURENKOV, A. A.

[Abstract] Photoelectric displacement converters are widely used in measurement systems, because they provide high accuracy of measurement and no mechanical reaction to the object. The speed of movement of the object in such systems is proportional to the frequency of signals from the converter.

so that the task of measurement of speed is reduced to measurement of frequency. Measurement of low frequencies (up to 1 KHz) with a speed of response of about 100  $\mu$ s and an accuracy of a few percent can be achieved by the use of devices which measure the instantaneous frequency of photoelectric signals. The range of measurable rates can be increased while retaining the speed of response and accuracy by the use of two channel measurement systems in which the first channel contains a difference intensimeter sensitive to the direction of motion while the second channel contains an instantaneous quadrature signal frequency meter. A block diagram of such a device is presented and it is noted that with an input signal of 3 v, the nonlinearity of the static characteristic of the device is not over 2 percent for frequencies of 20-20,000 Hz. Figure 1; references: 3 Russian. [181-6508]

UDC 621.3.087.92:621.382

#### CLASSIFICATION OF STRUCTURES OF INTEGRAL MECHANOELECTRICAL CONVERTERS

MOSCOW IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 27-29

VAGANOV, V. I.

[Abstract] A classification is presented of devices which utilize the strain sensitivity in semiconductors for conversion of mechanical quantities, particularly pressure, to electrical voltages. Such devices can be classified according to the material of the elastic element used, the material of the base, the material of the strain-sensitive (converting) element, the crystallographic orientation of the base of the elastic and sensitive elements, membrane shape, the shape of the strain-sensitive element and the topology of the strain-sensitive elements on the membrane. Diagrams of the various structures which can be used are presented. The types of devices which have been manufactured to date are briefly listed. Over 90 percent of all of the integrated transducers of this type are tensoresistors. References 25: 11 Russian, 14 Western. [181-6508]

## FUNCTIONAL TRANSDUCERS OF THE ROTATION ANGLE BASED ON ROTATING TRANSFORMERS

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 23 No 3, Mar 80 pp 29-33 manuscript received 6 Feb 79

KURCHAVYY, V. A.

[Abstract] Rotating transformers are used as functional transducers converting the rotation angle to an electric signal in various computer, measurement and automated systems for control of technological processes (ASUTP). Here such devices are considered which convert the angle to pulse width in the output signal, the width of these pulses not varying much with fluctuations of the input voltage. A rotating transformer can operate in the linear mode or in the sine-cosine mode. In the former case both the input voltage and the output voltage are rectified to proportional dc voltages and these are sent to a comparator, one directly and one through a chopper and an integrator. The width of pulses at the comparator output is functionally related to the transformer rotation angle. An error analysis indicates the need for suppression of ripple voltages, which can be done by proper phasing. According to experimental data, an almost zero conversion angle and a nonlinearity error within  $\pm 0.1$  percent are attainable even under a  $\pm 20$  percent voltage fluctuation. The error analysis is analogous for a rotating transformer in the sine-cosine mode. The paper was recommended by the Department (Kafedra) of Automation and Telemechanics, Smolensk branch of the Moscow Power Engineering Institute. Figures 3; references: 5 Russian. [218-2415]

UDC 681.3

## AN INTEGRATING FUNCTIONAL ANALOG-TO-DIGITAL CONVERTER

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 23 No 3, Mar 80 pp 34-37 manuscript received 12 Jan 79

MELIK-SHAKHNAZAROV, A. M., SAVIN, V. V. and DADAYAN, YU. A.

[Abstract] A functional converter of alternating voltage through time interval to code is described in which the measured voltage and the reference voltage are alternately integrated over a constant time interval equal to half the voltage period. The device includes two switches, an analog integrator, a comparator, a control circuit and a counter. With the

proper compensation voltage and with or without a bias voltage, the integrator can produce a cosinusoidal or a sinusoidal output. The converter is linear, generating a code proportional to the input parameter. With an inherently high immunity to noise harmonics, a conversion error as small as 0.5 percent is feasible. Such a device has been built with series 155 and 140 integrated microcircuits for a selsyn set used in drilling operations. The paper was recommended by the Department (Kafedra) of Information and Measurement Technique, Moscow Institute of the Petrochemical and Natural Gas Industry imeni I. M. Gubkin. Figures 1; references: 3 Russian. [218-2415]

UDC 681.3.087.92:62-501

#### METHOD OF INCREASING THE ACCURACY OF ANGLE-TO-DIGIT CONVERTER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 10-11

ISUPOV, A. N.

[Abstract] The use of structured methods is a promising means of increasing the accuracy of angle-to-digit converters (TsPU). Structured methods are divided into methods for decreasing the quantization (interpolation) error and methods for decreasing instrumental errors in the system. During interpolation, the quantization error can be decreased to an arbitrary level, so that the accuracy of the TsPU is determined basically by the sensitivity of the converter to the effects of destabilizing factors. These errors result from unstable random processes such as drift and aging. They are therefore systematic for short periods of time and methods of automatic correction can be used to decrease them. One such method is analyzed in this article. It consists in the fact that the interrogation signal is fed to two sensors separated by one quantum in space in sequence and the output signals of the sensors are scanned, periodically changing the level of selection with time. This method was utilized in a transformer converter with an 8-position code scale and multipole sensors in the low-order position, and provided a resolution of 14 bits. Figures 2; references: 4 Russian. [181-6508]



INTERACTION OF AN ELECTRON BEAM AND A BOUNDED NONLINEAR PLASMA

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 383-384  
manuscript received 10 Apr 79

AYZATSKIY, N. I., BALAKIREV, V. A. and TOLSTOLUZHSKIY, A. P.

[Abstract] Interaction of an electron beam and a high-frequency plasma wave is considered, and the possibility that stress due to plasma density redistribution caused by the force of high-frequency pressure will improve the efficiency of beam energy to wave energy conversion. This is demonstrated by the example of a cylindrical plasma waveguide containing cold ions and hot electrons, all in a strong magnetic field, assuming a slow variation of the amplitude and the phase of the electric field intensity due to the excited wave. The system of equations describing the steady-state amplification process has been integrated numerically for zero and near-zero initial values. The results confirm that at a certain value of the critical parameter self-induced stress will increase the maximum amplitude of the wave and correspondingly the power output from the beam. Figures 1; references: 4 Russian.

[224-2415]

PARAMETRIC FREQUENCY CONVERSION AT MILLIMETER AND SUBMILLIMETER WAVELENGTHS  
DURING EXTENDED INTERACTION OF WAVES AND HOT CHARGE CARRIERS IN A SOLID-  
STATE PLASMA

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 363-371  
manuscript received 17 Feb 78; after revision 5 Oct 79

KATS, L. I. and SAFONOV, A. A., Saratov State University

[Abstract] A theoretical study is made of extended parametric interaction between a strong electromagnetic radiation wave and a signal in a semiconductor plasma where both are coupled through a nonlinearity produced by heating of charge carriers. The plasma is assumed to behave according to classical laws. The process is governed under these conditions by the excess electron temperature, calculated from the equation of energy balance, while the components of the conduction current density are calculated from the equation of momentum balance by series expansion of the momentum relaxation frequency. This interaction is attended by a parametric frequency conversion, depending on the intensity of the pumping field and on the frequency mismatch, the amplitudes of coupled waves being found from the field equations. Numerical data have been obtained for n-InSb at 77 K with  $n = 10^{14}$   $\text{cm}^{-3}$ ,  $\mu_e = 5 \cdot 10^5$   $\text{cm}^2/\text{V}\cdot\text{s}$  in specimens of various thicknesses where a strong wave of frequency  $\omega_{10} = 10^{10}$  rad/s and a signal wave of frequency  $\omega_{01} = 10^{12}$  rad/s interact. In the submillimeter range of wavelengths there is only little desynchronization of wave vectors and interaction should be rather efficient. Figures 3; references 6: 2 Russian, 4 Western (1 in translation).

[224-2415]

## MEASUREMENT OF CORRELATION SCALES CHARACTERIZING THE FLUCTUATIONS OF FIELD INTENSITY AND COHERENCE IN LASER BEAMS IN A TURBULENT ATMOSPHERE

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 322-325  
manuscript received 12 Apr 79

BORONOVYEV, V. V., GOMBOYEV, N. Ts., MIRONOV, V. L. and TRUBACHAYEV, E. A.  
Institute of Atmospheric Optics, Siberian Division of the USSR Academy of Sciences

[Abstract] Field intensity and coherence fluctuations in a one-mode laser beam were measured simultaneously under conditions of strong intensity fluctuations, in a turbulent atmosphere, for the purpose of establishing the spatial correlation between these fluctuations and verifying an approximate theory of this correlation. The measurements were performed with a transmitter and a receiver including a diffraction lens 1.84 km apart in the Ulan-Ude district. The coherence radius  $\rho_{coh}$  and the structural characteristic of fluctuations of the refractive index in air were determined from the distribution of mean intensity in the focal plane of the receiver lens. Because of technical difficulties in realizing small spatial separations, it was necessary to reconstruct the correlation functions from the averaging function and to determine the latter from successive pairwise readings of the relative dispersions of intensity fluctuations. All measurements were accurate within 25 percent. The results have yielded a correlation radius  $r_{cor} \approx \frac{\rho_{coh}}{3/5}$ . The authors thank Ch. Ts. TSYDPOV for the interest and M. S.

BELEN'KIY for programming the reconstruction of correlation functions. Figures 1; references 18: 16 Russian, 2 Western.  
[224-2415]

## DENSITY OF FORCES ACTING IN A FLUID IN AN ELECTROMAGNETIC FIELD

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 372-374  
manuscript received 2 Jul 79

GINZBURG, V. L., Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] The density of forces in a fluid in an electromagnetic field is analyzed, disregarding the Lorentz force and assuming the fluid to be non-magnetic. Quasi-steady conditions prevail, for instance, when a rather long train of electromagnetic waves is reflected by a mirror surface inside the fluid. Experiments show that in a viscous fluid whose behavior under perturbations approaches that of a solid body with an increasing role of elasticity forces the latter compensate not only the hydrostatic pressure gradient but also all striction forces, which is interpreted here as not only not surprising but entirely natural. References 8: 3 Russian, 5 Western. [224-2415]

## COMPETITION BETWEEN WAVES IN A NONLINEAR ACTIVE MEDIUM WITH RANDOM INHOMOGENEITIES

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 378-380  
manuscript received 25 Apr 79

BOGATYREV, YU. K., Gorkiy Polytechnic Institute

[Abstract] Several, specifically two, nonresonant quasi-harmonic waves are considered as propagating through an active medium which is slightly nonlinear (electric conductivity has a large constant component and a small component proportional to the electric field intensity squared) and slightly nonhomogeneous (dielectric permittivity has a large constant component and a small component varying at random along the x-coordinate). The interaction of both waves is characterized by competition between them, possibly resulting in a monochromatization of the spectrum, which depends on those random fluctuations of the dielectric permittivity. This has been demonstrated experimentally and is here interpreted theoretically. In nonconservative nonlinear structures such as a tunnel diode, for instance,

fluctuations of the capacitive parameter can result in filtration of the low-frequency components rather than in a mere attenuation of all spectral components of all waves. The author thanks V. V. TAMOYKIN for the valuable comments and N. G. DENISOV for useful discussion. Figures 2; references: 9 Russian. [224-2415]

UDC 538.574.4

#### COHERENT SCATTERING OF ELECTROMAGNETIC WAVES INDUCED BY A RELATIVISTIC BEAM OF OSCILLATORS

Gorkly IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 353-362  
manuscript received 18 Apr 78; after completion 2 Aug 79

MIROSHNICHENKO, V. I.

[Abstract] Coherent scattering of electromagnetic waves by a relativistic electron beam is analyzed on the basis of a kinetic theory which accounts for the dependence of such an induced scattering on the beam characteristics. Accordingly, to the fundamental Maxwell equations with the intensities of the electric field and the magnetic field representing a superposition of three waves there is added a kinetic equation for the electron distribution function in the beam. This system is solved on the assumption that the incident wave, the scattered wave and the transmitted wave are all in phase. A nonlinear dispersion equation for scattering is obtained as a result. Scattering of an extraordinary electromagnetic wave by a cold relativistic low-density electron beam is next considered specifically, and the buildup of the scattered wave is calculated for the case of longitudinal plasma oscillations as well as for the case of a blurry (with respect to longitudinal velocities) electron beam. In the case of scattering of such a wave by a beam of unphased oscillators, moreover, an instability is established which underlies the operation of cyclotron-resonance masers. The author thanks YA. B. FAYNBERG for the continuous attention and interest as well as for a discussion of the results. References 15: 9 Russian, 6 Western. [224-2415]

## EFFECT OF AMPLIFICATION OF FLUCTUATIONS DURING REFLECTION IN A TURBULENT ATMOSPHERE

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 326-331  
manuscript received 4 May 78; after revision 16 Jul 79

KOVAL', B. S., PATRUSHEV, G. YA., PETROV, A. I. and POKASOV, V. V., Institute of Atmospheric Optics, Siberian Division of the USSR Academy of Sciences

[Abstract] Space and time distributions of amplitude and phase fluctuations of a wave beam during lateral reflection at a plane mirror surface in a turbulent atmosphere are analyzed by the approximate method of smooth perturbations. The amplification of amplitude fluctuations is found to remain appreciable so long as the reflection angle does not exceed double the angle of the first Fresnel zone. The amplification of phase fluctuations is found to be appreciable for all diffraction dimensions of the radiator, even when the reflection angle becomes equal to the angular scale of external turbulence. As the reflection angle becomes equal to several Fresnel zones, the amplitude fluctuations have shifted slightly and the phase fluctuations have shifted appreciably toward lower frequencies relative to their respective positions in the frequency spectrum without reflection. Figures 3; references 12: 11 Russian, 1 Western.  
[224-2413]

## FORMATION OF ARTIFICIAL PERIODIC INHOMOGENEITIES IN MAGNETICALLY ACTIVE IONOSPHERIC PLASMA

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 278-286  
manuscript received 20 Mar 79

TOLMACHEVA, A. V., Gorkiy State University

[Abstract] Formation of artificial periodic inhomogeneities in ionospheric plasma by an electromagnetic standing wave is examined, taking into account the effect of the geomagnetic field as well as the effect of local electron heating dominant in the E-layer and the effect of striction forces dominant in the F-layer. The distribution of electron concentration, in the case of an ordinary wave and in the case of an extraordinary wave, is calculated from the equations of motion (ions and electrons), continuity (ions and electrons), and heat conduction (electrons only). An analysis of the results reveals that the rise and the rate of rise of electron concentration as well as the

length of the transient period all depend on the angle between the vector of the perturbing wave and the vector of geomagnetic field intensity. As this angle becomes larger, furthermore, the changeover from stronger heating effect to stronger striction effect and the consequent change in the nature of the transient processes will occur at a higher altitude. The author thanks V. BELIKOVICH, YE. A. BENEDIKTOV, B. N. GERSHMAN and G. I. TERIN for the helpful comments and discussion. References: 8 Russian. [224-2415]



## ENERGY SOURCES

UDC 624.314.722.1.001.3

### ELECTROMAGNETIC PROCESSES IN POLYPHASE DEVICES WITH SEMICONDUCTOR SWITCHING ELEMENTS

Minsk IZV. VUZ: ENERGETIKA in Russian No 3, Mar 80 pp 21-25 manuscript received 17 Jun 79

ANISIMOVA, G. S., engineer, ZHURAVSKAYA, V. I., and ROGINSKAYA, L. E., candidates of technical sciences

[Abstract] Devices in energy conversion systems are considered which combine electromagnetic and semiconductor elements. One such device is a 3-phase voltage stabilizer with a linear choke in each line followed by a  $\Delta$  switch and a Y load. Each arm of the switching circuit consists of another linear choke in series with two parallel-opposing thyristors and a capacitor across this combination tuned to series resonance at line frequency with the line choke. Voltage and current transients are calculated for thyristors open and closed respectively, by approximating their current-voltage characteristics and using convolution integrals. An overall performance analysis is possible on this basis. Results indicate that the transient time does not exceed three periods of the line voltage, with the harmonic content in the output voltage not exceeding 10 percent. The paper was presented by the Department (Kafedra) of Electrical Machines of the Ufa Institute of Aviation imeni S. Ordzhonikidze. Figures 3; references: 2 Russian.  
[219-2415]

INSTRUMENTS, MEASURING DEVICES AND TESTERS; METHODS OF  
MEASURING; GENERAL EXPERIMENTAL TECHNIQUES

UDC 534.321.9.08

OPTICAL DEVICE FOR MEASUREMENT OF THE GROUP VELOCITY OF ULTRASOUND

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 68-69

BONDARENKO, A. N., DROBOT, YU. B. and VOLOGDIN, V. K.

[Abstract] An installation is described in which acoustical pulses are excited in a solid medium by laser radiation and recorded, allowing the propagation time in solids to be measured with an error of not over 1 ns. A ruby laser radiates single pulses 25 ns in length with a power of 30 MW. The pulses excite individual acoustical pulses in a plate, which propagate between the walls of the plate. They are recorded by a laser interferometer with a transmission band of 250 MHz. The electric pulses from the output of the interferometer pass through an amplifier and shaper to a frequency meter which operates in the mode of measurement of time intervals with a clock cycle time of 10 ns. The frequency meter thus measures a time interval corresponding to twice the transmission time of the acoustic pulse. Figures 1; reference: 1 Russian.  
[181-6508]

UDC 621.317.75:621.337.2

A PRECISION DEVICE FOR IMAGING GRAPHIC INFORMATION FOR A DIGITAL OSCILLOGRAPH

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 31-32

BARANOV, R. P., BERKUTOV, A. M., GUTMAN, V. M., MOROZOV, V. N. and PARAKHIN, V. A.

[Abstract] The CRT's used in digital oscillographs to date have a number of shortcomings: sensitivity to magnetic and electric fields, defocusing, nonlinearity and small angle of view. The use of matrix indicator panels can completely avoid these shortcomings and expand the capabilities of the digital oscillograph. A gas discharge ac indicator panel can be used as the basis of an imaging device to create a more accurate measurement device.

Such devices with precision electrode systems have error-free digital addressing of each indicated element, high information capacity and high resolution plus great brightness and contrast, small size and weight, as well as insensitivity to magnetic and electric fields. They are also undemanding in terms of power supply voltages. Figures 2; references: 4 Russian. [181-6508]

UDC 621.318.126.089.68

#### STANDARD SPECIMENS OF MAGNETIC PROPERTIES OF MAGNETICALLY HARD FERRITES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 46-48

ARTEMOVA, M. A.

[Abstract] A new type of standard specimen for magnetically hard materials, made of magnetically hard ferrites, has been developed. The new standard specimens have been approved by the State Standards Commission and entered into the State Register of Measures and Measurement Devices. The complete standard specimen set for magnetic properties of magnetically hard ferrites consists of five specimens differing in dimensions and properties. Three are cylindrical and two are rectangular parallelepipeds. The types of magnetically hard ferrite used in the set of specimens are widely used in practice. Because they have little mechanical strength, the specimens are enclosed in a protective nonmagnetic metal case not over 0.01 mm longer than the specimens. The specimens are guaranteed to maintain stable magnetic parameters for at least 12 years; however, considering the possibility of appearance of latent internal mechanical defects, reattestation of standard specimens should be performed each 2 years. References: 3 Russian. [181-6508]

## INCREASING THE TESTABILITY OF DISCRETE DEVICES. STATUS OF THE PROBLEM

Moscow IZMERENIYA, KONTROL', AVTOMATIZATZIYA: NAUCHNO-TEKHNICHESKIY REFERATIVNYY SBORNIK in Russian No 1-2, 1980 signed to press 6 Dec 79 pp 25-31

KHALCHEV, V. P., candidate of technical sciences

(Abstract) An attempt is made to evaluate the capability of modern testing methods to diagnose the condition of discrete devices, and to prove the promise and the need for intensive development of the little-studied area of planning of testable devices. The concept and criteria for testability of discrete devices are introduced, and the latest results in this area are analyzed. Practical methods for increasing testability include: separation of the analog portion of apparatus from the discrete portion on different boards; giving preference to synchronous nonredundant circuits; separation of clocks, pulse shapers and dynamic logic from static logic; design of flip-flops with a fixed initial state; avoidance of global feedback in structures or at least provision of the ability to break such global feedback loops for testing purposes; and provision of test points at the outputs of complex subsystems within larger systems. Figures 2; references 24: 7 Russian, 17 Western.  
[195-6508]

## MATERIALS

UDC 621.315.5.003.13+620.93.003.13

### EFFECT OF LIMITED RESOURCES IN SEMICONDUCTOR MATERIALS AND FUEL/ENERGY RESOURCES ON THE SELECTION OF CONDUCTOR AND CABLE SIZES

Minsk IZV. VUZ: ENERGETIKA in Russian No 3, Mar 80 pp 81-84 manuscript received 12 Feb 79

BATOV, B. I., candidate of economic sciences, Dotsent, "Order of Labor's Red Banner" Ural Polytechnic Institute imeni S. M. Kirov; and MEDNIKOV, YE. I., candidate in economic sciences, Chelyabinsk Polytechnic Institute imeni Leninskiy Komsomol

[Abstract] Selection of conductor and cable sizes on the basis of economy requires an evaluation of material costs and fuel costs, the latter reflecting most of the energy losses. Here this problem is solved by extending the V. V. Novozhilov formula for differential costs to include the efficiency of utilization of natural resources. This formula yields the optimum cross section and, with the aid of available data, the effect of limited resources on the optimum current density. The selection point is found to shift to a 3-6 percent larger cross section, but should not shift by more than by 10-11 percent owing to a critical fuel-energy balance. The concept of "closing" costs, already applied to fuel and electric energy, must also be applied to nonferrous metals. While the demand for oil and coal will increase by a factor of 5.2 and 4.5, respectively, from 1970 to 2000, the demand for copper and bauxite will also increase by a factor of 4.8 and 4.2, respectively, over this period. Bauxite is scarce in the USSR and nepheline as well as alunite can be mined, but this requires additional capital investments. References: 10 Russian.

[219-2415]

## OPTIMIZATION OF THE MICROTHERMOSTAT DESIGN FOR HYBRID INTEGRATED CIRCUITS

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 23 No 3, Mar 80 pp 91-95 manuscript received 18 Apr 79

ALEKSEYEV, V. P. and VIBE, P. F.

[Abstract] Design of microthermostats and thermostating microcircuits is considered from the standpoint of optimization, the precision of maintenance of the substrate temperature being dependent on the construction of the device as well as on the method of temperature control. The latter must be as simple as possible, a proportional regulation being a typical example. Assuming the substrate to be an isothermal body, the influence of the main design parameters (thermal resistances and heat capacities in the heater-sensor-substrate-housing system, all depending on the dimensions and the materials of the components) has been studied according to the theory of automatic control, with analog simulation of transient processes and by factorial experiment. A microthermostat consisting of a sensor (2T360 transistor crystal), a KT80 heater and a temperature stabilizing substrate (beryllium ceramic) has been designed on this basis which has a static regulation error not exceeding 0.05 K over the 223-323 K range of ambient temperatures. With such a microthermostat, the temperature drift of the output voltage in various hybrid IC devices can be reduced to below 0.1 microvolt K. The paper was recommended by the Department (Kafedra) of Radio Equipment Design and Production, Tomsk Institute of Automatic Control Systems and Radioelectronics. Figures 3; tables 1; references: 2 Russian. [218-2415]

DESIGN OF AN ELECTROOPTICAL MODULATOR USING A  $\text{Pb}_3\text{MgNb}_2\text{O}_9$  CRYSTAL

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 23 No 3, Mar 80 pp 67-71 manuscript received 2 Mar 78

LEKONTSEV, V. M., MIKHEYEV, V. P. and ROZOV, B. S.

[Abstract] A birefringent crystal of lead-magnesium niobate is among the best cubic crystals available for high-contrast wide-aperture light beam modulators. Here such an electrooptical modulator is examined which has the control electrodes deposited on the light-transmitting crystal face either perpendicularly or parallel to the direction of light propagation, and with the electrostatic field applied normally to it. The distribution of the electrostatic field intensity is calculated for each case, especially on and around the axis, as well as the half-wave voltage. The calculations, based on conformal mapping of the crystal section to a rectangle with the electrodes on opposite faces, reveal that for every interelectrode distance there is a certain crystal thickness at which the half-wave voltage becomes minimum and remains at this level when the thickness is further increased. A completely analytical solution of this problem is not possible. The paper was recommended by the Department (Kafedra) of Automation and Telemechanics, Moscow Institute of Engineering Physics. Figures 3; references: 5 Russian. [218-2415]



## CALCULATION OF RAY DIFFERENTIALS IN OPTICAL SYSTEMS

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 23 No 3, Mar 80 pp 72-76 manuscript received 16 Jan 78

RODIONOV, S. A.

[Abstract] In computer-aided design of optical systems derivatives of real light rays or infinitesimally thin light beams are used for astigmatism calculations, but there many other possible applications. Here differentials of light rays are defined with the aid of Feder coordinates and a Hesse matrix. The algorithm of calculating them consists of three steps: transformation of coordinates with subsequent differentiation, transfer of the point of incidence on the ray to a given surface from the preceding one, and refraction. In the last step it is appropriate to consider the case of chromatic differentials. The algorithm covers the general case of oblique rays in any optical system, but the expressions are much simpler for the special case of a meridional ray in a centered optical system. The paper was recommended by the Department (Kafedra) of Optical Devices Theory, Leningrad Institute of Precision Mechanics and Optics. Figures 1; references 5: 3 Russian, 2 Western. [218-2415]

## A MULTICHANNEL ELECTROOPTICAL MODULATOR BASED ON A CRYSTAL OF LEAD MAGNIOBATE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 3, Mar 80 pp 29-30

BRAGIN, M. YE., KOL'TSOV, I. M., LEKOMTSEV, V. M. and MIKHEYEV, V. P.

[Abstract] Multichannel electrooptical modulators are widely used, for example for parallel optical processing of signals, multichannel sound recording and recording of rapid processes. PMN crystals, which are cubic crystals, do not have the birefringence which is the primary source of errors in other crystals used for electrooptical conversion, but do manifest a significant electrooptical effect. A six-channel electrooptical modulator was constructed using a PMN crystal 0.8 mm long in the direction of propagation of the light. Studies of the modulator showed great dispersion of parameters in different channels, indicating that there were optical

heterogeneities in the crystal. The modulation factor varied from 30 to 100 in different channels, but the mutual influence between neighboring channels was not over 1 percent for a voltage of 100 v applied across one of the channels. Figures 1; references 4: 3 Russian, 1 Western.  
[181-6508]

UDC 621.315.62:537.523

VOLTAGE-TIME CHARACTERISTICS OF INSULATOR CHAINS SUBJECT TO NONSTANDARD LIGHTNING OVERVOLTAGE PULSES

Minsk IZV. VUZ: ENERGETIKA in Russian No 3, Mar 80 pp 16-21 manuscript received 30 Oct 79

ALEKSANDROV, G. N., doctor of technical sciences, Professor, DZHURAYEV, SH. I., engineer, and KIZEVETTER, V. YE., candidate of technical sciences, Dotsent

[Abstract] Insulator chains were tested in the High-Voltage Engineering Laboratory of the Leningrad Polytechnic Institute (30x40 m<sup>2</sup> floor area) with pulses from a 4.8 MV generator. The chains consisted of 13 PF-6B or 13 PF-6C insulators (220 kV class) and of 25 PS-12A or 25 PS-16A insulators (500 kV class), the distance from the cap of the top insulator to the cross-beam being set to 15-20 and 40 cm, respectively. The pulse rise time and duration were 1.9/40, 3.3/45 and 7.5/50  $\mu$ s. The number of tests performed was at least 15 at each step of charging voltage and at least 30 at each step corresponding to 50 percent discharge voltage. A statistical analysis of the results has yielded the voltage-time characteristics of such strings which evidently vary depending on the pulse shape. Below the 50 percent discharge level, with a long predischage time, a longer rise time results in lower voltages. Above the 50 percent discharge level, on the other hand, the predischage time becomes longer with a longer rise time. Generally the voltage-time characteristics here are similar to those of an air gap between a rod and a plate, with intersection of curves. Within the test range these characteristics depend neither on the string length nor on the ratio of leakage path length to string length. In the case of a predischage time shorter than 7  $\mu$ s lengthening of the leakage path by a factor of 1.23 will raise the discharge voltage by 7-8 percent. The paper was presented by the Department (Kafedra) of Electrical Apparatus of the "Order of Lenin" Leningrad Polytechnic Institute imeni M. I. Kalinin. Figures 3; tables 1; references 6: 4 Russian, 2 Western.  
[219-2415]

## PRODUCTION TECHNOLOGY

UDC 621.317.7.088.7:621-251

### INFLUENCE OF MANUFACTURING ACCURACY ON SENSITIVITY OF ELECTROMECHANICAL ELEMENTS

Moscow IZMERITEL'NAYA TEKHNICA in Russian No 3, Mar 80 pp 17-18

ARMENSKIY, YE. V., IVAN'KO, A. P., KUZINA, I. V. and FALK, G. B.

[Abstract] To find the influence of technological error on the output characteristics of a machine, one must find the relationship between electromagnetic asymmetry and the resultant radial force. The radial component of electromagnetic force can be found by using the principle of virtual work. This principle is applied to analysis of the influence of radial force on the sensitivity of actuating induction micromotors. The mathematical expressions produced can be used to estimate the influence of technical errors on the accuracy of a number of electromechanical elements of automatic measurement devices, and to determine technological tolerances based on preassigned accuracy figures in the stage of automated planning. Figures 1; references: 2 Russian.

[181-6508]

UDC 621.317.33:621.778.27

### NONCONTACT MEASUREMENT DURING WINDING OF THE RESISTANCE OF RESISTIVE PRODUCTS MADE BY INSULATED WIRE

Moscow IZMERENIYA KONTROL', AVTOMATIZATZIYA: NAUCHNO-TEKHNICHESKIY REFERATIVNYY SBORNIK in Russian No 1-2, 1980 signed to press 6 Dec 79 pp 18-24

DIMITRAK, S. N., candidate of technical sciences

[Abstract] The manufacture of wire-wound resistive elements has required the development of new methods for noncontact measurement of resistance as wire is wound onto bobbins. Possible methods of connection of wire-wound elements into electric circuits as they are manufactured are diagrammed and the potential for resistance measurement mathematically calculated. The

method of simultaneous measurement and comparison of currents or voltages is recommended as the most accurate for a variety of winding methods. It is recommended that the bobbin be shorted during winding in order to increase the accuracy of winding of resistors when the length of wire on the bobbin is relatively short. Figures 7; tables 3; references: 14 Russian. [195-6508]

DETERMINING THE COHERENCE OF THE FIELD IN A REGULAR MULTIMODE OPTICAL GLASS FIBER

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 23 No 3, Mar 80 pp 302-309  
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[Abstract] A mathematical model is constructed for evaluating the performance of long glass fibers in optical systems with an He-Ne laser by means of measurements of the mutual coherence between the field of such a laser and the field at the exit end of such a fiber. The model is based on mode analysis and the measurement data are, according to it, processed so as to yield the distribution of illuminance over the fiber cross section and the distribution of the number of wave modes in the fiber with respect to phase constants and time delays. This model has been statically simulated on a computer and found to be useful for either estimating beforehand the degree of coherence which will result from a known radial distribution of the refractive index or, conversely, estimating the anticipated width of the pulse response at the fiber exit from the measured degree of coherence. The author thanks R. F. MATVEYEV, I. P. KORSHUNOV and V. N. TUTUBALIN for the valuable comments and discussion. Figures 5; references: 7 Russian,; 1 German translated.

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